Competition, Productivity, and Survival of Grocery Stores in the Great Depression

by

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Abstract

We study the grocery industry in Washington, DC, during the Great Depression using data from the 1929 Census of Distribution, a 1929–1930 survey by the Federal Trade Commission, and a 1935 business directory. We first document the differences between chains and independents in the Washington, DC, grocery market circa 1929 to better understand chains' competitive advantages. Second, we study correlates of survival from 1929 to 1935, a period of major contraction and upheaval. We find that more productive stores survived at higher rates, as did stores with greater assortment and lower prices. Presaging the supermarket revolution, combination stores were much more likely to survive to 1935 than other grocery formats.

Keyword*:* Grocery Stores, Survival, Great Depression, Chains

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1 Introduction

The consequences of recessions for productivity, particularly the relationship between productivity and survival, have been of interest to economists at least since Joseph Schumpeter. The sheer magnitude of the downturn in the Great Depression makes it a particularly interesting case in which to examine this process of selection. Most studies of this period have focused on the manufacturing or agricultural sectors, with retail receiving comparatively little attention. This gap is unfortunate, as this was a period of rapid change in the sector. For example, Field (2006) calculates a total factor productivity growth rate of 2.39% for the period 1929 to 1941 in retail and wholesale trade. Moreover, the retail-trade sector is economically important, accounting for 10.6% of national income in 1929, more than all of agriculture.

Within retail, the grocery industry was in the midst of several transformations during the period we study. Presaging the development of the supermarket in the 1950s, "combination" grocery stores for the first time sold both meat and dry goods such as flour, oil, and coffee. Stores were beginning to adopt the self-service format, first introduced in 1916, which allowed customers to shop without the intervention of the clerk. Large national grocery chains were taking over the industry, inspiring many state legislatures to pass anti-chain-store legislation starting in the mid-1920s (Ross, 1986).

We draw on a novel sample of store-level records from the 1929 Census of Distribution (CoD). This survey was the first comprehensive tally of U.S. retail and wholesale operations and includes almost 1,900 grocery-store schedules (forms) from Washington. We combine these records with microdata from a 1929–1930 Federal Trade Commission (FTC) inquiry on chain stores that obtained detailed information on store selection and prices. We control for local demand using demographic characteristics of the population in each store's Census tract from the 1930 Census of Population. Finally, matching the CoD records to a business directory from 1935 allows us to study survival and understand its relationship to business and neighborhood characteristics in 1929.

We use these rich data to paint a picture of the retail grocery industry in Washington, DC, at the start of the Great Depression. The literature on early chain stores has cited various facts about early chain stores, including their lower prices and more "modern" logistics. Chain stores were reputed to have succeeded by standardization, better site selection, leaner inventory, vertical integration, and private labels. Standardization included common store layouts and common product selection.[1] Our analysis confirms some of these but cast doubt on others. In particular, we find that chains carried both a wider range of nationally branded products and more varieties within a product category than independents, but that assortment varied considerably both across chains and, to a lesser extent, within chains. We develop a measure to quantify this correlation in product assortment across stores and show that, although not all stores in a chain carry the same set of products, within-chain product assortments are much more correlated than would be expected due to chance.

Comparing chains and independents, we find that chains have higher average levels of productivity. Even more striking is the difference in the dispersion of productivity across these two groups: chain stores have a very tight productivity distribution, whereas independents' productivity is much more dispersed; the most productive independents are at least as productive as the most productive chain stores. Although chains in our data have low prices, not all chain stores are created equal: one chain, Safeway, stands out as having particularly lower prices. Finally, we show that characteristics of the local population are correlated with chain-store status. Chains tend to be located in Census tracts with fewer competitors per capita, lower black and foreign-born population shares, and smaller average family sizes. All of these are consistent with chains' greater propensity to weather the Great Depression.

The second contribution of the paper is our analysis of survival rates of grocery stores between 1929 and 1935. The Great Depression represents the most striking episode of a sharp business cycle and large productivity change in U.S. history. Averaged over the whole period from the peak in 1929 to the pre-war peak in 1941, the American economy experienced

[1]For background literature, see Vaile (1932); Beckman and Nolen (1938); Lebhar (1950); Barger (1955); Tedlow (1990); Ellickson (2016).

its fastest rate of productivity growth in its history (Field, 2011). Despite this impressive performance for the longer period, Ohanian (2001) notes the downturn from 1929 to 1933 was characterized by sharp declines in productivity in the manufacturing sector. However, very little is known about the performance of the retail sector during this time period and about the drivers of success within the retail sector. We help fill in this gap in the literature.

There is a substantial literature on productivity and survival during the Great Depression in the *manufacturing* sector. Bresnahan and Raff (1991) argue that automobile manufactures during the Depression faced strong selection pressures on productivity driven by the differences between mass- and craft-productive processes. In a reanalysis of this industry, Lee (2014) suggests that selection was in fact on the size of the establishment. In a study of the radio industry at this time, Scott and Ziebarth (2015) finds that the type of productivity that mattered for survival was not physical productivity (i.e., units produced per unit of inputs) but revenue productivity (revenue dollars per unit of inputs). Some modern studies such as by Fort et al. (2013) focus on predictors of survival in the Great Recession. For example, they find that young businesses were particularly hard hit by the Great Recession, whereas older small businesses fared better.

We identify some similarities with modern studies and studies specific to the period as well as some differences. We also find tentative evidence that older stores survived the Depression at higher rates, although our measure of age is calculated at the store, not firm, level. Our evidence on the importance of firm size is mixed: small chains had lower survival rates than single-store independents, but large chains' experience was idiosyncratic and harder to generalize. Also, consistent with the literature on productivity, labor productivity is a strong predictor of survival. Consistent with the growth in store size over the decades, we document positive selection on two measures of store assortment: among chains, combination stores survived at much higher rates than traditional grocers, and among independents, store assortment, a measure not previously used in this literature, was a strong positive predictor of survival. Finally, stores facing more competitors per capita in their Census tract experienced

higher exit rates.

2 The Grocery Industry on the Eve of the Depression

The grocery industry, like much of the retail sector, has experienced both growth in store size and growth in chain size over the last century. Chain stores accounted for a negligible share of grocery sales in 1899 (Barger, 1955, Table B-6, p. 148). From 1919 to 1929, the share of grocery stores operated by the top five grocery chains grew from 4.2% to 24.5% (Ellickson, 2016, Table 15.1, p. 371). In Washington, DC, the reported number of chain stores increased from five in 1913 to 43 in 1922, and then to 145 in 1928 (Federal Trade Commission, 1933b, Table 3, p. 9).[2] The biggest chain by far in 1929 was the Great Atlantic and Pacific Tea Company (A&P), followed by Kroger, American Stores, Safeway, and First National. By 1930, A&P's revenues had topped $1 billion, or more than $14 billion in 2016 dollars (Levinson, 2011, p. 125). This growth of chains inspired a strong anti-chain movement, which, starting in 1927 and continuing into the early 1940s, resulted in the passage of special taxes on chain stores in 27 states (Ross, 1986). During the Great Depression, possibly partially as a result of these chain-store taxes, chains stagnated. From 1929 to 1939, the number of chain grocery stores fell as a share of all grocery stores, although chains' share of revenue stayed constant at about 38% (Lebhar, 1950, p. 67).

Besides the growth of grocery chains, there were a number of technological innovations that would come to shape the grocery industry from 1929 through the Great Depression. Levinson (2011, pp. 125-127) cites three innovations, external to the grocery industry, that reshaped the way grocery retailing operated: refrigeration, the automobile, and packaging.[3] The combination of refrigeration — in both stores and homes — and the availability of cars to transport larger shopping loads allowed consumers to consolidate shopping trips

[2]This figure was based on retrospective inquiries of chain stores in the FTC inquiry. Although it acknowledged that these numbers may be inaccurate, the FTC believed that the figures were "sufficiently comprehensive to indicate with substantial accuracy the general trends in such growth" (p. ix).

[3]Lagakos (2016) cites the diffusion of refrigeration and cars to explain increased productivity in the retail sectors of developing countries.

rather than shopping daily, particularly for meat, dairy, and produce. Cellophane, which was both transparent and freshness-preserving, made it possible for butchers to sell precut and prepackaged meat since consumers could see through the packaging material. Levinson argues that these three innovations combined to increase store size. The trend of increased store size has continued with grocery stores selling an increasing array of products, from an average of 867 in the mid-1920s to over 30,000 by the 1990s (Messinger and Narasimhan, 1995, Figure 2).

These larger stores did not resemble today's supermarkets. So-called "combination stores" that sold both staples (bread, flour, sugar) and meats and gradually came to replace the separate butcher and grocery stores, but they were small by today's standards. The "model" combination store, according to the publication *Progressive Grocer*, measured only 1,200 square feet (Levinson, 2011, p. 127).[4] At the time of the 1929 Census of Distribution, combination stores accounted for 115,549, or 24%, of stores in the broad food group. "Supermarkets" existed, but there were very few of them; by one count, there were fewer than 400 supermarkets in the U.S. by 1935 (Ellickson, 2016, p. 374). In addition, the vast majority of grocery stores in 1929 still offered full service: a customer would approach the counter and ask the clerk for specific items, and the clerk or a helper would supply the goods. The emergence of the "self-service" store, said to have been pioneered in 1916 by Piggly Wiggly (Marcossen, 1945), changed this dynamic: in a self-service setting the customer roams around the store and selects (pre-packaged, individually wrapped) items for purchase. This necessitated both a change in the format of retail stores and a change in manufacturing and packaging processes — from bulk to individually packaged, from customized to standardized sizes. Levinson argues that the invention and widespread use of Cellophane was instrumental to the eventual success of the self-service format.[5]

[4]Today's supermarkets average over 45,000 square feet, nearly 40 times larger than the original combination stores (Ellickson, 2016, p. 368).

[5]Although the 1929 "long-form" version of the 1929 CoD schedule, which was used for "all retail establishments (except food, drug stores, and automobile and accessories establishments) in cities having 10,000 inhabitants or more which did a business of $60,000 a year or more," asked whether stores offered self service, the responses were never tabulated in any publication. In our sample of Washington, DC, stores, 90% of

3 Data

We use business microdata from three sources: the 1929 Census of Distribution; the 1929–1930 Federal Trade Commission inquiry; and the 1935 edition of a Washington, DC business directory. We supplement these sources with demographic data from the 1930 Population Census.

3.1 Census of Distribution

The 1929 Census of Distribution (CoD) is the first comprehensive survey of the retail industry in the United States. Approximately 1.5 million stores in total were enumerated. The CoD was administered during the first half of 1930. Although intended to capture the retail environment in 1929, it likely missed businesses that closed before enumerators got to them, and it included some businesses that did not exist in 1929. Various tabulations were made and published with some detail down to the county level. We have digitized the micro data for Washington, DC, from the original schedules, which are currently held at the National Archives.[6] The CoD is described in detail in Appendix A.1.

We have attempted to geocode the locations of all businesses in the Washington, DC, CoD based on the reported addresses. This is not an exact process due to spelling errors and changing street names. We have successfully geocoded 1,921, or 98.5%, of the 1,951 stores we classify as grocery stores.[7] The top panel of Table 1 shows summary statistics for the CoD sample of grocery stores, combination stores, and delicatessens in Washington, DC. Approximately 30% of stores belong to a chain; the rest are single units ("independents"). Chain sizes vary from 1 (single units) to 15,000 (A&P). The average store had revenue

stores receiving the long form (form 11 or form 13) answered this question; of these, only 17%, or 30 stores, indicated they offered self service.

[6]To the best of our knowledge, the only other source that collected store-level data for the retail sector around this time is from the Harvard Bureau of Business Research (HBBR) (see McNair, 1931, 1934; McNair et al., 1941; McNair and May, 1963). The HBBR collected data on department stores annually from 1921 onwards and on various other types of stores starting in 1929. Although the HBBR has the advantage that it covers more than a single point in time, existence of the records is very mixed (Scott and Walker, 2011).

[7]We drop 26 observations whose geocodes fall outside the DC city limits

of almost $40,000 in 1929 (about $560,000 in 2015 dollars), but there was also significant variation in that. On average, a store has a single proprietor and three employees. The average store's workers collectively work 10,000 hours, again with a very wide range.

3.2 Federal Trade Commission Inquiry

We supplement the CoD, which lacks information on the assortment and prices of goods, with data from a 1929–1930 FTC investigation into chain stores in five cities.[8] The FTC inquiry targeted "retail selling prices, costs, and gross margins of chains and other distributors in the grocery, drug, and tobacco trades" (Federal Trade Commission, 1933a, p. 1). The forms for this inquiry asked stores to report prices of 450 consumer goods. We assume that each store carried only those products for which prices are listed; from this, we determine store assortment.[9] We describe the data in detail in Appendix A.2.

To match the CoD and FTC datasets, we have geocoded the FTC sample. We have successfully geocoded 831, or 99.3%, of the 837 surveys. We search for possible name matches in the FTC dataset for each CoD observation, restricting our attention to geocoded stores that are located within 200 meters of the CoD address. We supplement this with a hand search of the remaining records. Of the 1,954 CoD stores we classify as delicatessens, grocery, or combination stores, we are able to match 676 to FTC schedules.

The bottom panel of Table 1 shows summary statistics for the CoD sample that is successfully matched to the FTC. We exclude the largest chains because their FTC interviews, which occurred more than a year after the independents' interviews, excluded key questions; the only information the FTC schedules provide for the largest chains are prices and assortment, and because of the deflation from 1929 to 1930, even the prices are not directly comparable. This sample therefore includes only 427 of the original 1,895 stores and is heavily skewed towards single-store grocers, with a few small chains (up to eight stores). These stores are smaller and older on average, and have slightly lower labor productivity but higher

[8]The other cities studied in this investigation were Cincinnati, Des Moines, Memphis, and Detroit.
[9]Matsa (2011) uses similar logic to determine out-of-stocks in modern supermarkets.

inventory-turnover rates.

3.3 Boyd's Business Directory

To study business survival, we need a later source of information on the existence of particular businesses. Unfortunately, although the retail and wholesale sectors were surveyed in both 1933 (as part of the renamed Census of American Business) and 1935 (as part of the Census of Business), the micro data from these censuses no longer exist. Instead, we supplement our data with the 1935 edition of *Boyd's District of Columbia Directory* (Polk, 1935). This directory was published by a private company, much like the yellow pages today. The directory states that it is a "complete" guide to businesses and not restricted to only paid subscribers. We assume that this directory provides a comprehensive listing of our population of interest.

We find 45% of CoD grocery stores in the Boyd's file, implying an exit rate of 55% over six years, or an average exit rate of about 14.5% per year. Figure 1 shows a map of all grocery stores geocoded from the 1929 CoD. Black dots represent survivors — businesses that match by name and/or address to a business in the 1935 Boyd's directory. Gray dots represent exiters.[10]

3.4 Local Demographics

Finally, we include 1930 demographic information at the Census tract level from Minnesota Population Center (2011). For each of the geocoded CoD businesses, we have identified the relevant 1930 Census tract and gathered the following demographic information: total population; population by race (white, black, or other) and, for whites, nativity (native or foreign); population by age group; population by sex; and total number of families. These tracts are very narrow geographic regions, comprising of approximately 5,000 individuals, or

[10]We have reason to believe that these exit rates may be over-estimated due to incomplete matching, but they are nevertheless within the reasonable range. For details on our matching methods and a comparison of our computed exit rates to other sources from the same period, see Appendix A.3.

1,250 families, each. There are a total of 95 of them in Washington, DC.

4 Competitive Advantages of Chains

It is received wisdom that companies like A&P had at least two major competitive advantages: "high volume and low prices" (Tedlow, 1990, p. 182). What were the fundamental sources of these advantages? Discussing the related British retail sector, Scott and Walker (2017) quote Michael Marks, a founder of Marks & Spencer, who believed that the "statistical control of stocks in relation to sales" — i.e., the ability to exploit data from cash registers — was central to the productivity advantage of the chains. In this section, we consider three possible sources of advantages for chains: prices, productivity, and assortment.[11]

4.1 Classification of Chains

There were three large grocery chains with a presence in Washington, DC, in 1929. The largest national chain by far was the A&P, with approximately 15,000 stores nationwide (Lebhar, 1950); 144 of its stores were in Washington, DC. American Stores, with 2,644 stores nationwide (American Stores, 1930), had 36 stores in Washington. Safeway, as Sanitary Grocery Company, reported having 2,562 stores nationwide on its CoD forms, of which there were 311 in Washington. We use the term "Big 3" to refer collectively to these three chains.[12] Our data also include representatives from other national chains.[13] We classify stores that did not belong to chains, including stores that were members of the cooperative District Grocery Stores, as "independents."

[11] To our knowledge, no data exist on stores' access to technology, but a back-of-the-envelope calculation suggests that cash registers were ubiquitous in the U.S. by this time (Basker, 2016).

[12] They are, in fact, chains #1, #3, and #4 nationwide at this time (Ellickson, 2016, Table 15.1); the second-largest chain, Kroger, was concentrated in the Midwest (The Kroger Grocery & Baking Company, 1931).

[13] These include one Jewel Tea Co. store (of 1,215; Jewel Tea Company, Incorporated, 1930), one Grand Union Tea Co. store (of 707; Grand Union Company, 1931), three John R. Thompson Co. stores (of 120, according to its CoD forms), two Huylers stores (of a reported 53), and several other small chains, about which we were not able to find additional information.

In Table 2, we compare independent stores to the full set of chain stores, as well as to each of the three largest chains on a number of characteristics. On average, independent stores have lower productivity and revenue than chains. Among the three large chains with stores in the Washington, DC area, American Stores has substantially lower labor productivity. All of the chains are more likely to be combination stores, and all of them spend less on part-time workers, as a percentage of total salaries, than independent stores.

4.2 Prices

Many have argued that chains' lower prices derived from negotiating lower wholesale prices of goods.[14] In line with this view, we find that chains had lower prices. This finding, however, is subject to some caveats. The FTC inquiry proceeded in two phases, with independents' prices collected in August 1929 and chain prices collected in November and December 1930. Figure 2 shows the price indices we calculated for chains and independents using two different adjustments for deflation. Panel (a) shows prices adjusted by the all-items CPI to August 1929 levels, and panel (b) shows prices adjusted by product-specific deflators. (The deflators are described in Appendix A.2.)

Regardless of the deflator used, Safeway's prices were lower than those at independent grocery stores. The two adjustment methods give different qualitative results for the other two chains, A&P and American Stores, however. Using the CPI, which adjusts all prices equally, the three chains' prices are tightly clustered and 5% lower than prices of independent grocers, whereas using the product-specific deflators, which allow for greater deflation in the price of flour than in the prices of milk and sugar, A&P and American Stores' prices appear much closer to those of independent stores. Although we do not know how representative these products are of the broader grocery basket, the finding that chain stores charged lower

[14]Beckman and Nolen (1938) report on a 1935 study of 533 Florida grocery stores — approximately 10% of the grocery stores in the state at the time — and calculate on the basis of this study that consumers would save between three and five percent by shopping at chains vs. independents (p. 98). This study forms the basis of Tedlow's (1990) claim that chains charged lower prices than independents during this time period. Vaile (1932, Table 27) finds an even larger price difference in Minneapolis, but one that varied by district, with 1931 prices 6.6% higher on average at independent stores than chain stores.

prices than independent grocers is consistent with other observations and dates back to the original FTC report. Ross (1986) writes that, according to the FTC study, "about 15 percent of the chains' price advantage could be explained by the lower prices they paid their suppliers" (p. 248), a finding some used as proof that independents were being discriminated against.

4.3 Productivity and Inventory Turnover

The next question we consider is to what extent chains were more productive than independents or operated. To do this, we calculate two measures of store-level productivity. First, following much of the literature on retail productivity, we calculate a store-level labor productivity measure:

$$\text{Labor productivity} = \ln\left(\frac{\text{Revenue}}{L}\right)$$

where the numerator, our measure of output, is net revenue — gross revenue less returned goods and allowances — and L is total hours worked at the store, from the CoD.[15] There are at least two limitations to our measure of productivity. First, a measure of gross margins, calculated by subtracting the cost of goods from sales revenue, would be preferable as a measure of output, but the CoD, like the modern CRT, does not have information about wholesale costs. Second, because we lack complete information on retail prices, we are unable to distinguish between high measured productivity due to high prices or expensive goods and high measured productivity due to high physical quantities (for a discussion, see Foster et al., 2008). Our above finding on price differences between chains and independents suggests that, all else equal, measured revenue productivity is biased downwards for chains relative to independents.

Figures 3 and 4 show the distributions of revenue and labor input (hours), respectively;

[15]The modern CRT does not distinguish between full-time and part-time workers, so productivity is generally measured as revenue per worker rather than revenue per hour (see, e.g., Foster et al., 2002). A few recent studies have attempted to measure store TFP; see Maican and Orth (2015, 2017). We lack consistent data on inputs other than labor, so we cannot follow their methods.

and Figure 5 shows the distribution of store productivity. In each case, we show the distribution separately for the three largest chains and for all other stores. The revenue distributions are similar for the three chains, but have a substantially lower mean, and larger variance, for the independents. The hours distribution is less clear-cut. For all but American Stores, the hours distribution is bimodal, but once again it is much more dispersed for independents than for chains. Finally, the productivity distributions for Safeway and A&P are shifted to the right and tighter than for American Stores and for independents. The fact that the productivity distributions for the chains are shifted to the right relative to the independents is particularly remarkable given the finding on prices.

An alternative measure of productivity is the store's inventory turnover rate:

$$\text{Inventory turnover} = \ln\left(\frac{\text{Revenue}}{\text{Inventory}}\right)$$

Higher turnover represents more efficient use of inventory. One benefit of this measure is that it abstracts from the price differences between chains and independents as long as inventory is valued using retail prices. Figure 6 shows the distribution of inventory turnover, again distinguishing between the Big 3 and other stores. Unlike labor productivity, inventory turnover is no higher for chains on average than it is for independents, although as with labor productivity, dispersion is much tighter for chains. This casts doubt on the hypothesis that inventory control was an important source of competitive advantage for chains. A possible alternative interpretation of these differences is that high turnover rates are a sign of credit constraints that prevent a business from holding a larger amount of inventory. In this case, to the extent that chains have easier access to credit, all else equal they should have lower inventory turnover rates compared to independents.

4.4 Assortment

In 1929, grocery chains were ascendant, but stores were still relatively small; the supermarket — located on the edge of town, selling mostly national brands — had yet to come to dominate the market (Ellickson, 2016). Still, chain stores in our matched CoD-FTC sample clearly carried more products. In the terminology of Betancourt and Gautschi (1990), chains exhibited more product breadth as well as depth. This is surprising, because among the advantages of chains — A&P specifically — enumerated by Tedlow (1990), a commitment to private labels is central (p. 183). Yet the products for which the FTC collected prices were overwhelmingly national brands. For coffee, for example, the FTC inquiry collected prices of a one-pound tin of each of the following brands: Maxwell House, Orienta, Lord Calvert, and Seal Brand; a one-pound box of Wilkins Breakfast; and a $2\frac{1}{2}$-ounce tin of G. Washington Powdered coffee. For cocoa, three sizes were included for each of two brands – Baker's and Hershey's. The same is true for lard, breakfast cereals, salad dressing, sandwich spreads, and the other products included in the FTC price survey.

Panel (a) in Figure 7 shows the fraction of products with nonmissing prices, which shows a bimodal distribution. The assortment offered by chains is both dramatically larger and, similar to productivity, exhibits much lower dispersion. One possible explanation for this finding is mechanical, and has to do with the data construction process: if the FTC imputed prices for chain stores based on information from either the chain's headquarters or other stores in the chain, more prices would be available for chain stores. However, in Panel (b) of Figure 7 we see wide variation in the number of products within stores in the same chain. This is true even when we drill down into specific product categories. For example, among the 37 American Stores in the FTC sample, two have no cheese products, one has one cheese price, eight have three, six have four, nine have five, and so on — two stores have eight distinct products within the cheese category. For Safeway stores, 39 of the 151 stores sampled have prices for 14 distinct cake products, but one store has only two products and one store has as many as 22. These appear to be fairly representative.

To quantify the similarity in product assortment across stores that make up a chain, we introduce the following statistic for a given chain with N stores,

$$\rho = \frac{1}{N(N-1)} \sum_{i=1}^{N} \sum_{j \neq i}^{N} \frac{\#(P_i \cap P_j)}{\#P_i}$$

where for store i, P_i is the set of products offered, $\#P_i$ is the number of products offered in store i, and $\#(P_i \cap P_j)$ the number of products offered in both i and j. We can think of the set of products offered at different levels of aggregation. A measure of how broadly similar stores are within a chain is whether they carry similar product types, such as peanut butter, breakfast cereal, or salad dressing. However, for the purpose of thinking about whether chains exploit purchasing power to extract lower prices, it is useful to consider brands within a narrow product category, such as quarts of milk.[16]

We calculate the average of this statistic across all chains for the 44 product categories (product breadth). We find that the within-chain value of the assortment statistic ρ, averaged across all chain stores, is approximately 0.987. The values are fairly stable across chains: 0.99 for Safeway and A&P, and 0.98 for American Stores. These extremely high values reflect the fact of that these stores carry wide assortments of products: Safeway, for example, carries 36 of the 44 product categories in every single store sampled, and another six in all but one or two stores sampled.

Next, we calculate the assortment statistic ρ within products. Using brands of quarts of milk, we find $\rho = 0.86$; for 12oz packages of flour, $\rho = 0.94$.[17] To benchmark the magnitude of this statistic, we take a dartboard approach: we construct synthetic chains that are the same as the real chains in terms of number of stores as well as the number of products offered in each store, but each synthetic store is stocked by randomly sampling from the set

[16]We interpret this statistic as a pairwise covariance of the products on offer. It is equal to 1 if $P_i = P_j$ for all $\{i, j\}$, this is, if all stores with a chain stock the same products; and 0 if the intersection of P_i and P_j is empty for all $\{i, j\}$, that is, if stores within a chain stock *dissimilar* products. More generally, ρ takes on values between 0 and 1; it cannot take a negative value.

[17]We can only calculate this statistic for milk, flour, and sugar, because we did not collect within-product assortment from the FTC forms for other products.

of products the chain carries. Figure 9 shows the distribution of values of ρ for quarts of milk based on 250 simulations. The actual value of ρ exceeds the largest value in the simulations, which leads us to reject the null hypothesis that chains stock products randomly. The fact that this statistic is larger than the simulated values is consistent with chains stocking similar brands across their stores.

These within-product assortment coefficients reflect chains' tendency to have one or two dominant brands carried by most or all of their stores, and a larger set of optional brands, carried by a smaller number of stores. For example, 122 of 129 Safeway stores carried Alderney brand milk quarts and none offered the Wise brand; none of the A&P stores in our sample carried Alderney, but 70 of the 77 carried Wise.

To summarize, we find that chains stock a similar range of products across stores. Within a narrow product category, such as milk or flour, stores tend to carry similar but not identical assortments, with some chains specializing in specific brands. If supply contracts are established at the chain or level, specializing in one or two brands may lead to lower wholesale prices, and allow the chains to undercut independent grocers. This is consistent with the view of the existing literature. Stevens (1937, p. 44) argues that at least some of chains' cost advantage was due to differences in costs of supplying large and small orders; as noted earlier, the logic behind the Robinson-Patman Act was similar (Ross, 1986).

4.5 Local Characteristics

Finally, we explore the possibility that chain locations were different from — and possibly superior to — locations of independent stores. First, we compute, for each Census tract, the number of stores per 1,000 residents. Panel (a) of Figure 8 shows the distribution of this variable for each of the three large chains and for the independent stores and small chains. Compared to the large chains, independents were much more likely to be located in competitive tracts. The most competitive tract, with more than 20 stores per capita, had 98 independent stores, 7 Safeway stores, and only one each of A&P and American Stores.

In contrast, independents constituted only half of stores in tracts with fewer than 2 stores per capita.

Panel (b) of Figure 8 shows the percentage of the tract population that is black for each type of store. Here again there is a contrast between chains and independents: independent stores are more likely than chains to locate in majority-minority tracts. Although we do not have income by race, other research suggests that black residents earned lower wages than white residents. For example, Margo (2016) shows the black-white income ratio from 1900 to 1940 was between 0.3 and 0.4.

We find a similar pattern for other proxies of location quality: chains are more likely to locate in areas with a smaller share of foreign-born white residents (panel (c)) and average family size (panel (d)). If foreign-born white residents, and larger families, were more likely to be poor than native whites, this implies that chains were located in more upscale neighborhoods. Finally, we have also compared the distributions of residents per square mile across the different store types; this figure (not shown for brevity) does not show meaningful differences in the population density for chains and independents. Overall, independent stores' locations appear to be inferior to chain stores' locations. All of these variables are likely correlated with store size. Smaller stores are likely to be located in older and poorer areas. Newer store formats, which are larger, may have required more space and therefore been located in newer or more upscale neighborhoods.

5 Survival Analysis

To study correlates of store survival, we estimate cross-sectional linear probability models for surviving from 1929 to 1935:

$$\text{Survive}_i = \text{Store}_i\beta_S + \text{Firm}_i\beta_F + \text{Local}_i\beta_L + \varepsilon_i \tag{1}$$

where Survive_i is an indicator for survival, and the vectors Store_i, Local_i, and Firm_i are store, firm (chain), and local characteristics for store i, respectively. The Store vector includes variables that have been shown to predict survival of establishments in the retail and service sectors such as business age, size, and productivity. The Firm vector includes an indicator for being part of a chain and separate indicators for each of the Big 3 chains. The Local vector includes the store's 1930 Census tract-level demographic characteristics (log population, log white population, log population over age 21, and log native-born white population), and level of competition as proxied for by the log number of competitors in the store's Census tract. All of our predictors are measured in 1929.

It is important to interpret the regression results with some caution. Omitted variables may cause bias in the estimated coefficients. For example, the higher fixed cost involved in setting up a combination store may mean that stores that have a higher expectation of survival, due to unobserved demand, management, or financing factors, are more likely to set up as combination stores. If this type of selection is important, the estimated coefficient on the combination-store indicator will be biased upwards. Similarly, we view store age, 1929 store revenue, and chain size as proxies for unobserved access to financing, managerial quality, and adaptability to market demand, over and above what is captured by labor productivity.

Table 3 presents results from a set of regressions on the full sample from the top panel of Table 1. In the first five columns, we include, in addition to the demographic variables, store characteristics — log labor productivity, log inventory turnover, an indicator for a combination store, log store revenue, and log store age — one at a time. The sixth column includes, instead of these store characteristics, a locality characteristic — log number of competitors in the tract. Subsequent columns include all store and locality characteristics, and then add the firm characteristics.[18]

[18]To avoid dropping approximately 200 stores missing store age we arbitrarily set their age to one; all regressions with store age also include an indicator, not reported, for missing age, to avoid biasing the age coefficient. Age is missing for 14% of the sample.

Consistent with prior literature on the relationship between productivity and survival (e.g., Foster et al., 2006), more productive stores have higher survival rates in our sample. In column (1), with only demographic covariates, this relationship is weak, but the coefficient becomes much larger in columns (7) and (8) when we control for other store and firm characteristics. A unit increase in log labor productivity — roughly the difference between the 25th and the 75th percentiles of the distribution — increases the probability of survival by about 12 percentage points. This effect is of the same order of magnitude as the one reported by Foster et al. (2006, Table 1).

In contrast, the inventory-turnover measure of productivity is negatively correlated with survival; this is true both when we control for only demographic covariates in column (2) and when we add store- and firm-level covariates in columns (7) and (8). One interpretation for this is that inventory turnover can also serve as a proxy for sensitivity to credit availability rather than productivity: stores with poor credit may carry less inventory, inflating the ratio of revenue to inventory. As noted by, for example, Richardson and Troost (2009), banks at this time played a key role in providing trade credit to finance wholesale purchases and inventory. Their work showed, in the context of a particular natural experiment involving the state of Mississippi and the Atlanta and St. Louis Federal Reserves, that businesses engaged in the wholesale trade were the most severely affected by bank failures. So it is possible that during the most severe period of financial distress in American history, the businesses most financially constrained would be most likely to exit. If inventory turnover is a valid measure of productivity for chain stores, but not for independent stores, the sign of the coefficient should flip in a sample of only chain stores. Table 5 shows additional regression results for the sample of the Big 3 chains only. In this sample, the coefficient on inventory turnover is positive and significant. An alternative explanation is that stores whose owners or managers expect them to survive may carry higher inventory than stores that are expected to be shut down in the near future.

In columns (3) and (4), we estimate the relationship between store size and survival.

We use two measures of store size: a combination-store indicator in column (3), and store revenue in column (4). We find that combination stores survived at a higher rate than grocery stores, but revenue, not controlling for combination-store status, is negatively correlated with survival. The combination-store effect is consistent with the general trend towards larger stores; this trend began in this period and has continued ever since. Levinson (2011, p. 128) reports that A&P was in the process of upgrading from mostly traditional grocery stores to more combination stores; other grocery chains embraced the nascent "supermarket" format even faster. These signs and significance levels survive including both variables in the same regression, alongside controls, in column (7). We note, however, that interpreting the coefficients on revenue is complicated in columns (7) and (8), because revenue is, implicitly or explicitly, included in four different variables: explicitly as log revenue; and implicitly in both productivity measures, as well as in the combination-store indicator.[19] Although the sum of the first three effect is positive (1.3 in the regression in column (7) and 4.8 in column (8)), the main impact of revenue on survival works through the combination-store indicator. This finding suggests that combination stores were better suited to survive the Great Depression, which may have accelerated the decline of the smaller, older, grocery format.

Store age is a signal of the store's previous ability to survive, and therefore likely to be correlated with local demand conditions, managerial skill, and access to financing. We include store age in the regression reported in column (5). Our measure of age is not directly comparable to modern studies that have focused on firm age as a proxy for the firm's access to resources (e.g., Fort et al., 2013). Like the previous literature, however, we find that age is positively correlated with survival. This effect, too, survives some controls, but not the firm-level controls in column (8).

Column (6) considers the relationship between survival and number of competitors in

[19] As detailed in Appendix A.1, the combination-store indicator is derived from the store name and list of lines of business for independent stores. Some chain stores report this variable as well; when they do not, the combination-store indicator is imputed from revenues. This imputation is based on our observation that there is a strong positive but nonlinear relationship between store revenue and its combination-store status.

the store's Census tract. Because the demographic controls include log population, this coefficient can be interpreted as the effect of competitors per capita. Stores located in more competitive tracts were less likely to survive. Because the count of stores is itself endogenous to local demand conditions and expected survival and profitability prospects, this coefficient is likely biased towards zero, so the true effect of competition is even larger. In both column (6) and, with additional controls, columns (7) and (8), a doubling of the number of competitors per capita reduces the probability of survival by 8–10 percentage points.

We add chain variables in column (8): an indicator for chain stores generally and three additional indicators, one for each of the Big 3 firms. We continue to include all of the Census tract-level demographics and all of the store-level characteristics already considered. Our interest in chains stems from the fact that they were ascendant during the 1920s and the Great Depression slowed their growth. We are also interested in the degree to which other variables, such as productivity and store revenue, have explanatory variation once we control for chain affliation, given that we observe higher labor productivity is higher in chain stores than in non-chains (Figure 5). Although small chains survived at lower rates than independents, the average survival rate of the Big 3 was not significantly different from that of independent stores, controlling for store-level characteristics. This is because the survival rate of Safeway stores was almost 50 points lower than that of independents, *ceteris paribus*, whereas A&P and American Stores survived at rates similar to independents.[20]

This finding suggests that the Great Depression was a period of chain dominance in the Washington, DC chain-grocery market. Independent stores and small chains competed with one another, and survived — or did not survive — as a function of their productivity,

[20]Safeway's contraction in the Washington, DC market during the Great Depression was likely related to its recent entry into this market. In November 1928, Safeway, which previously had no stores in the region, purchased the Sanitary Grocery chain, with "429 grocery stores and 67 meat markets located in the city of Washington, D.C., and vicinity" (Safeway Stores, 1928). Safeway had closed or divested nearly 40 of those stores within a year (Safeway Stores, 1929). Between 1929 and 1935, Safeway closed or divested another 133 of these stores (Safeway Stores, 1935). This contrasts with Safeway's expansion elsewhere: even as it closed more than a third of its stores in the Washington market, Safeway's nationwide store count increased from 2,501 in 1929 to 3,150 in 1935 (Safeway Stores, 1929, 1935).

assortment, and prices. Safeway, however, consolidated its holdings in the aftermath of a purchase of a very large number of stores in the market.

Table 4 repeats the five of the first six columns of Table 3, restricting attention to the matched FTC sample. For brevity, we omit the combination-store indicator. (We do not include firm-size variables in these regressions because there is virtually no variation in firm size in our matched sample.) Because the sample is substantially smaller, our power here is reduced. The productivity variables are insignificant, both in separate regressions (columns (1) and (2)) and in a regression with the full set of covariates (column (8)). Different from the full sample, the coefficient on store revenue in column (3) is positive. The effect of the log number of competitors per capita in column (5) remains negative, statistically significant, and similar to magnitude to the effect estimated in the full sample; although the signs do not change when we add the full set of control variables, both of these coefficients attenuate and become insignificant in column (8).

In columns (6) through (8) of Table 4 we add two variables computed from the FTC survey. First, we introduce (the log of) the number of the 450 products included in the FTC survey carried by the store. A doubling of the number of products sold — roughly, an increase in the number of products sold from the 25th to the 75th percentile of the distribution — is correlated with a 20-point increase in the probability of survival (column (6)). This effect, too, is muted and loses significance in the model with covariates, although the coefficient estimate remains positive and large (13.5). Although tentative, this result suggests that the format of the store was key to survival not just for chain stores but also among independent grocers.

In column (7), we add the price index we compute from the milk, flour, and sugar prices reported to the FTC. We find that higher prices are negatively correlated with survival. Although the coefficient on price is not statistically significant, it is also robust to the inclusion of all other store-level covariates. This suggests that the positive correlation between revenue productivity and survival may be driven, in part, by an even stronger correlation between

productivity based on real output and survival, and, in fact, there is selection against stores charging the highest prices.

6 Concluding Remarks

We use a rich set of sources to compile a comprehensive dataset on the Washington, DC, grocery market circa 1929, and on the survival of businesses to 1935. We uncover a few stylized facts that have not been previously documented. First, retail chains — primarily A&P, American Stores, and Safeway — had higher assortment and less dispersed productivity than independent grocery stores. This is true in our sample despite the fact that we exclude fruit and vegetable stalls and other very specialized stores (such as candy stores), which have lower assortment and are likely to have much more widely dispersed labor productivity, from our sample of independents. Second, we identify predictors of survival in a regression framework. Like previous studies, we find that labor productivity is an important predictor of survival. A new finding in our paper is that product assortment was a strong predictor of store survival during the Great Depression.

Our findings show the importance of the firm to store-level outcomes. We find strong correlation of assortment — both product breadth (product categories stocked) and product depth (brands for a specific product) — across stores within a chain. This correlation is stronger than what is suggested by a random assignment of products to stores. In addition, the importance of the chain fixed effects in exit regressions — and the fact that many other variables lose their explanatory power when these fixed effects are included — also suggests that the relevant economic mechanisms driving survival operate at the firm level, not the store level.

Our interpretation of the correlation between both store format (combination stores) and store assortment, on the one hand, and store survival, on the other, relates to the changing nature of grocery retailing during this time period. Store format is a measure of product

breadth: combination stores carried a distinct additional set of products that traditional grocery stores did not. Store assortment is a hybrid of product breadth and product depth: higher assortment can be the result of a store adding product categories, or adding sizes or brands of existing products. Both increased product depth and increased product depth can increase demand at the store. Increased depth increases store quality by providing opportunities for substitution of less-preferred for more-preferred brands (Ellickson, 2006), whereas increased breadth provides the advantage of one-stop shopping (Basker et al., 2012). At the same time, there is a cost to increasing both breadth and depth, which prevents store size from expanding without limit (Holmes, 2011); this cost may be particularly high for perishable items. The availability of refrigeration and other innovations changed the tradeoff between these forces (Levinson, 2011).

In the aftermath of the Great Depression and World War II, voters' and legislators' appetite for anti-chain-store laws diminished. The supermarket, an expanded version of the combination store, came to the American suburbs (Zimmerman, 1941, 1955), taking advantage of consumers' suburbanization, increased car ownership, and desire for one-stop shopping. Our work suggests that the Depression was key in sifting out particular types of stores and setting the stage for the major changes that came soon after.

A Data Appendix

A.1 Census of Distribution

The CoD is the precursor of Census of Retail Trade (CRT) and the Census of Wholesale Trade (CWT), which are part of the quinquennial (five year) Economic Census. The Economic Census covers almost the whole of the American economy, with the exception of the agricultural sector (covered by the Census of Agriculture administered by the U.S. Department of Agriculture) and the public sector.

The CoD's goal was to provide "information on the number of stores, personnel, pay roll, stocks, sales, operating expenses, seasonal employment characteristics, credit business, receipts from sale of meals, receipts from repairs and service of automobiles, merchandise manufactured by retailers, returned goods and allowances, country buying, retail sales of manufacturing establishments and wholesalers, sales to other retailers, forms of organization, and sales by commodities" (U.S. Department of Commerce, Bureau of the Census, 1933, Part I, p. 13). Bohme (1987, p. 229) reports that the 1929 CoD "was entirely a field operation," with enumerators visiting each of the stores to interview the owners, managers, or clerks.

The CoD publication classified 2,375 Washington stores in the broad "food group," of which 479 were grocery stores (without meats), and 1,031 were combination stores selling both groceries and meat, for a total of 1,510 (calculated from U.S. Department of Commerce, Bureau of the Census, 1933, Part II: Reports by States, Table 1, p. 425). We do not have access to the classification codes used for the tabulation, so our classification is based on the name of the business and on the type of business reported on the form.

The number of CoD schedules closely matches the number of stores reported elsewhere for specific chains. For example, Safeway's 1930 Annual Report listed 2,538 stores in the U.S., of which 391 were in Washington, DC (Safeway Stores, 1930). There are 311 Safeway (Sanitary Grocery Company) CoD schedules for Washington, DC; the chain reported having

2,562 stores nationwide on its CoD forms. The discrepancy is likely due to the annual report including the broader metro area, as well as differences in timing between the annual report and Census tabulations.

A sample completed CoD schedule is shown in Figure A-1. The fields common to all the forms collected by the CoD include basic identifying information such as name and type of business; street addresses, including city and county; and the name and race of the store owner. All businesses were also asked whether they belonged to a chain, the size of the chain, the date the business was established, and the date it came under the current owner. The economic variables collected include employment by gender and by full-time vs. part-time workers; revenue; the principal lines of goods sold; payroll, rent, and interest expenses; and inventories. These responses were self reported, filled out by either the store owner, manager, or clerk, or by an enumerator writing down the respondent's answers, and the markings on the schedule denote edits made by government enumerators or tabulators.

We classify stores as combination stores if their business description contains the string "meat." (A few stores that do not report meat in their name or business description but do report selling fresh meat in their FTC schedules, are also classified as combination stores.) For independent grocers, we believe this classification to be adequate, if noisy. Of the three largest firms in our data — A&P, Safeway, and American Stores — only the first reports lines of business on the forms, and then only for half its Washington stores. For these chains we therefore impute the "combination" status based on revenue. Half of Safeway's stores nationwide in 1929 were combination stores (Safeway Stores, 1929), so we impute the combination indicator to be one if the store's revenue were above the chain's median and zero otherwise. We use the same criterion for American Stores. For A&P, we know the configuration for half the stores — of these, 41% were combination stores. We apply the median rule to the remaining stores.[21,22]

[21]Only a quarter of A&P's stores nationwide were combination stores (Levinson, 2011, p. 127). Figure A-2 shows the distribution of revenue for A&P stores that reported being groceries-only or combination stores and for the stores for which we impute this variable.

[22]Of the 41 A&P stores that report being grocery (non-combination) stores, the median rule would have

We compute the total number of hours worked at the store as the sum of proprietors and full-time employees, multiplied by 2500 (50 hours/week · 50 weeks), plus part-time employees multiplied by 1000.[23] Finally, store age is calculated as the difference between 1929 and the year of establishment (or purchase by the current owner); the sample includes some stores that opened in 1930, which explains the minimum age of -1. 75.5% of stores have a firm age under current ownership of five years or older.

A.2 Federal Trade Commission Inquiry

The collection of the store-level prices from the FTC took place in two stages. In August 1929, the FTC obtained price schedules from 570 independent stores, cooperative stores, and small chains in Washington, DC, excluding the major chains (Safeway Stores, American Stores, and A&P). We have recovered 567 of the original 570 schedules for independent stores. At the time, it was believed that the heterogeneity in pricing among stores in a chain was so small that collecting data from individual stores was unnecessarily costly. Instead, one price list was obtained from each headquarters. However, after studies in other cities revealed some within-chain variation in prices, the FTC decided to study large chains.[24] These stores were visited in November and December of 1930. As these chains operated a large number of stores, a random sample was taken.[25] The chain-store portion of the survey omitted many of the detailed questions on store operations, focusing only on product assortment and prices. We have recovered all 270 of the chain-store schedules. Like the CoD, the FTC inquiry

correctly assigned 35, or 85%. Of the 29 A&P stores the report being combination stores, the median rule would have correctly assigned 22, or 76%.

[23]This is based on an estimate of the work week in manufacturing in 1930 of 50.6 (Whaples, 1990, p. 34). Foss (1981) argues that actual work hours in manufacturing were lower. For retail, however, this may be an underestimate. The FTC estimated that chain-store managers worked an average of 75 hours per week, although the report cautions that the number was based on a very small survey (Federal Trade Commisssion, 1932, p. 6).

[24]Today there is a trend towards uniform or near-uniform prices in many retail chains; see DellaVigna and Gentzkow (2017) for a recent discussion.

[25]The Sanitary Grocery/Safeway stores were listed in "numerical sequence" and the odd-numbered stores chosen (Federal Trade Commission, 1933a, p. 44), with 151 stores visited in total. The method for selecting A&P stores was similar except instead of a 50% sample, the FTC chose "in the neighborhood of two-thirds" and 82 stores were studied. Because the number of American Stores was smaller, only 37 within Washington, DC, all of them were visited.

schedules are self-reported, and the schedules are held at the National Archives.

Figure A-3 shows two pages from the paper schedule for one sampled business: Irving Delicatessen. The first page of the schedule asks for business name and address, whether the store sells on credit, accepts orders by telephone, or provides free delivery, the main product lines carried, and other business details. The following pages ask for prices for a range of products, starting with three brands of ginger ale. We have digitized all the identifying information from the first page, and the number of products with non-missing prices in each sub-category on the form, such as the number of ginger ale products, number of "near beer" products, etc., for 450 products in 44 detailed product categories. We have also digitized prices, when available, for a subset of products: two brands of sugar (three different sizes each); five brands of milk (two sizes of each); and four brands of flour (four sizes of each).

From the product-level prices, we construct a store-level price index, which is an average of the available relative prices for each store, weighted by the quantity of that good sold in the market.[26] A complication we encountered while creating the price index is that the economy had contracted and the U.S. experienced severe deflation between August 1929, when the independent stores were visited, and November and December 1930, when the chain stores were added. We use two methods of adjusting for the timing difference. The first method uses the CPI for "all items, all urban consumers."[27] As an alternative to the CPI, we have obtained, for each of these three months, the average wholesale price of fresh milk in New York, the average retail price of sugar in New York, and the average retail price

[26]The quantities come from the FTC published report (Federal Trade Commission, 1933a, Vol. 5, Appendix II), which records, among other things, the average net retail price and the total number of units of the good bought by independents and chains for a period of six months. The price of milk was not reported separately by brand, because, with few exceptions, chain stores and independent stores did not stock the same brands. The FTC believed this was not a problem, noting that "while some brands of milk and cream may be of better quality than others, the limits of variability are thought to be relatively narrow and the absolute differences in the prices of the various brands are slight" (Federal Trade Commission, 1933a, Vol. 5, p. 78). Following the FTC, we average the prices for brands of milk and treat it as one product. In addition, because of problems with the forms, the prices and quantities of the three Pillsbury flour products are missing (Federal Trade Commission, 1933a, Vol. 5, p. 55). Finally, for reasons we have not been able to determine, data for only two of the three sizes of Jack Frost sugar are included in the tables. We drop the products for which we do not have average prices and quantities, leaving us with 28 product-brand-size combinations.

[27]The CPI fell from 17.3 in August 1929 to 16.4 in November 1930 and 16.1 by December 1930, a 7.2% deflation over 16 months.

of flour in Minneapolis, all from the NBER Macrohistory Database.[28]

Besides providing additional information on the prices and assortment of goods, linking the FTC schedule also enables us to cross validate the two datasets by comparing variables common to both data sources. One such variable is the business's age. In the FTC survey, the question is asked only of independent stores and concerns the age of the business at its current location; the CoD asks about the year the business was first started and about the business age under current ownership. Figure A-4 compares the age under the current owner (CoD) with the age in the current location (FTC). Each blue circle represents one or more observations; the larger the circle, the more observations it represents. Triangles represent matched observations with a response in only one (or neither) dataset. The solid line shows the 45° line. Of the 409 observations with nonmissing values for both variables, 201 (49%) are along the 45° line; the correlation between the two ages is 0.74. We generate a "business age" variable by using the CoD-reported age under current owner, if available; otherwise, the CoD-reported age since business birth; and if both are missing, the FTC-reported age at the current location.

Similarly, we can compare sales revenues reported in the two datasets. The CoD dataset has net annual revenues and the FTC dataset has weekly gross revenues (for independent stores only). Although magnitudes are different because the variable definitions differ, the correlation between the two variables is very high at 0.83.

A.3 Boyd's Business Directory

As with the CoD and FTC samples, we geocode each business address and we use the geocoded data to identify survivors from the 1929 CoD. We have limited our matches to grocery, delicatessen, and combination stores. This subset has the advantage that we can include information from the FTC as well as the CoD in our regressions. For each CoD

[28] See `http://www.nber.org/databases/macrohistory/contents/chapter04.html`, accessed November 26, 2016. There is considerable variation in the deflation rates for these three products. Between August 1929 and December 1930, the wholesale price of milk in New York fell by 9.5%; the retail price of sugar in New York fell by 12.4%; and the retail price of flour in Minneapolis fell by 27.4%.

observation, we search for possible matches in Boyd's that are located within 200 meters of the CoD address. We code a business as a survivor if we can identify it in the Boyd's file using either the name and address or only the name, within the 200 meter radius. For chain stores, we limit matches to exact addresses, because in some cases chain stores have multiple locations in very close proximity. Based on the match of the CoD and Boyd's samples, our computed exit rate among Washington, DC, grocery stores, of 14.5% per year.

The 1929 CoD lists 5,931 stores in Washington, DC. The 1933 Census of American Business publication tabulates 6,156 stores (U.S. Department of Commerce, Bureau of the Census, 1937a, Table 3, p. 19), of which 1,972 stores, or 32%, opened after 1929 (U.S. Department of Commerce, Bureau of the Census, 1937a, Table 5, p. 2). This implies that 1,747, or 29%, of stores that existed in 1929 had exited by 1933. Between 1933 and 1935 exit rates are harder to determine: the 1935 publication lists 6,472 stores in Washington in 1935, of which 4,479 are "identical" to stores that existed in 1934 (U.S. Department of Commerce, Bureau of the Census, 1937b, Table A, p. 2). If "identical" stores include all survivors then at a minimum 1,677 stores closed between 1933 and 1935, but we do not know whether these stores are survivors from 1929.

Our computed exit rates may be too high if we simply fail to match some CoD observations to Boyd's due to differences in the name or address. Recall the match between the FTC survey and the CoD. The FTC and CoD surveys were both undertaken in 1929/1930. If we assume that the CoD captured the universe of retail stores, all or nearly all FTC survey respondents should have matched to the CoD. Instead, we successfully matched only 81% of the FTC observations to the CoD despite supplementing our matching algorithm with hand matching. One reason for the imperfect match may be the different timing of the two surveys. Specifically, the CoD took place in the first half of 1930, whereas the FTC survey took place in the summer of 1929 (independents) and in the fall of 1930 (chain stores); the CoD may therefore have included stores that opened after the 1929 wave of the FTC survey or closed before the 1930 wave. A less-innocuous reasons for the mismatch is an error in

a store's name or address in the CoD; this would also prevent us from matching the CoD observation to the Boyd's file.

We can put these exit rates in context by comparing them to modern exit rates in the retail sector. Jarmin et al. (2009, Table 2) calculate an average annual exit rate in the retail sector using data from 1976–2000, and find an annual exit rate of about 15% for single-unit retailers and 9% for chain stores. According to the Business Dynamics Statistics, in 2007, on the eve of the Great Recession, the U.S. economy had approximately 1.5 million stores. Six years later, in 2013, the number of stores ages six and higher (i.e., those that existed in 2007) had declined by 38%.[29]

We can also compare our exit rates to exit rates in other sectors during the Great Depression. Hansen and Ziebarth (2017), in a study of Mississippi drawing on records from Dun & Bradstreet covering all types of businesses in two large cities, Atlanta and St. Louis, find annual exit rates of 20–30% in the years just prior to the Great Depression and rates exceeding 60% in 1931. Other studies such as Scott and Ziebarth (2015) and Ziebarth (2012) find similarly high rates.[30] We have also found one study of retail turnover during this period: Vaile (1932), focusing on grocery retailing in the Twin Cities from the late 1920s, finds that just 45% of grocery stores in Minneapolis and 51% in St. Paul in 1930 had an age of five years or more (Table 5a). In our data, we find 43.7% of stores reporting an age (under current ownership) of over five years, similar to the rates above. Moreover, exceedingly high churn rates were common even before the Depression. Vaile also reports that 28% of grocery stores in Minneapolis, and 26% in St. Paul, exited the business in 1926. Thus, although we have reasons specific to our setting to believe that these exit rates are too high, we do not think they are excessively biased.

[29]See `https://www.census.gov/ces/dataproducts/bds/index.html`. Accessed September 21, 2016. These figures are not available by state or disaggregated industry.

[30]These studies were subject to many of the same matching issues as our study, such as address misspellings and inconsistencies in reported names.

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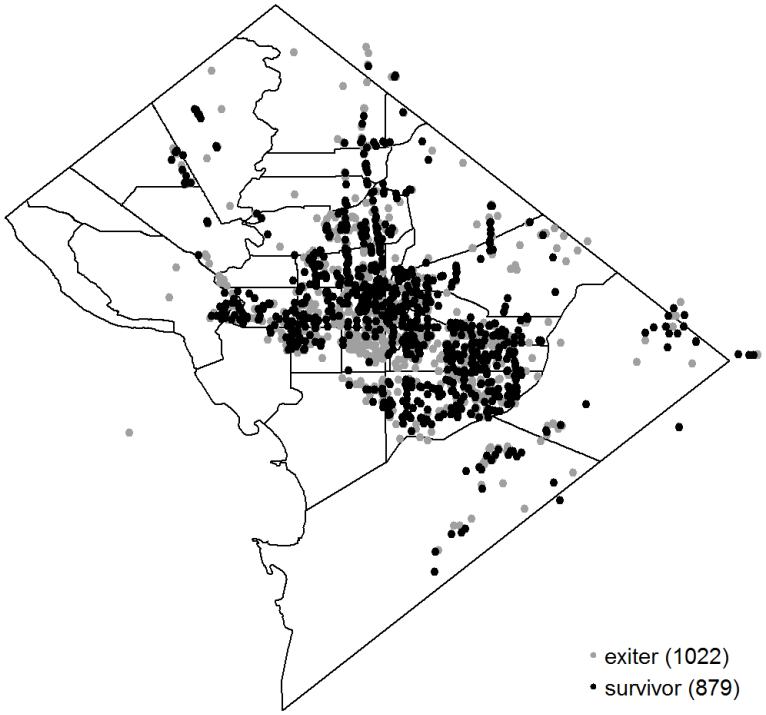
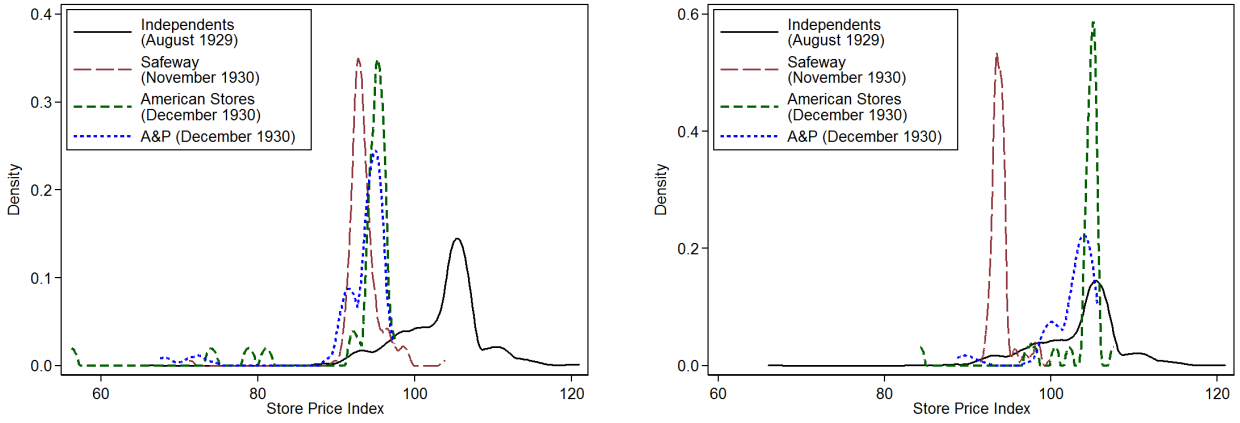
Figure 1. Locations of Washington DC Grocery Stores, 1929



Notes: Authors' calculations from 1929 Census of Distribution and Boyd's 1935 District of Columbia Directory

Figure 2. Price Indices for Washington DC Grocery Stores, 1929

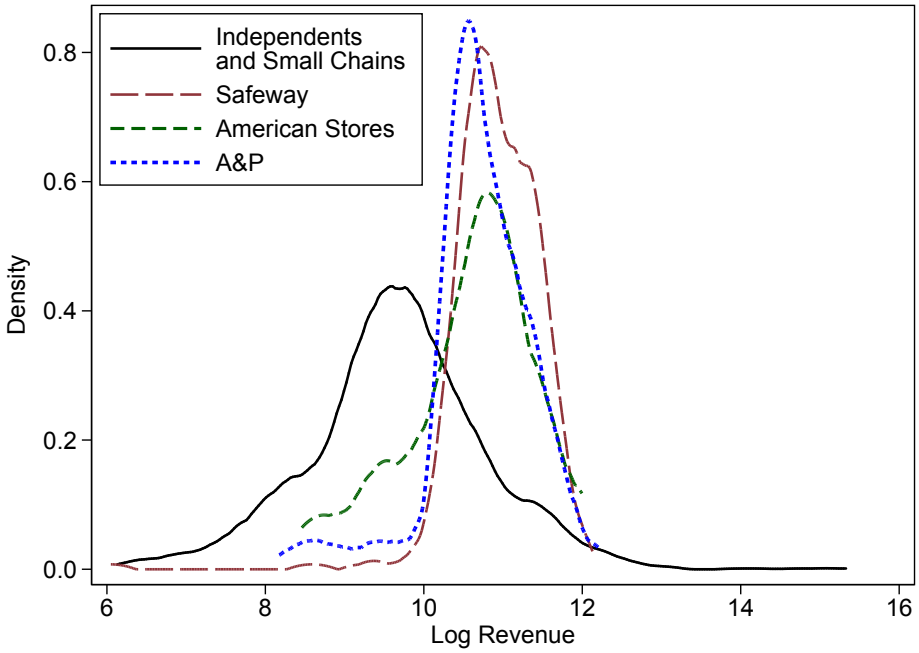


(a) Adjusted by CPI

(b) Adjusted by Product-Specific Deflators

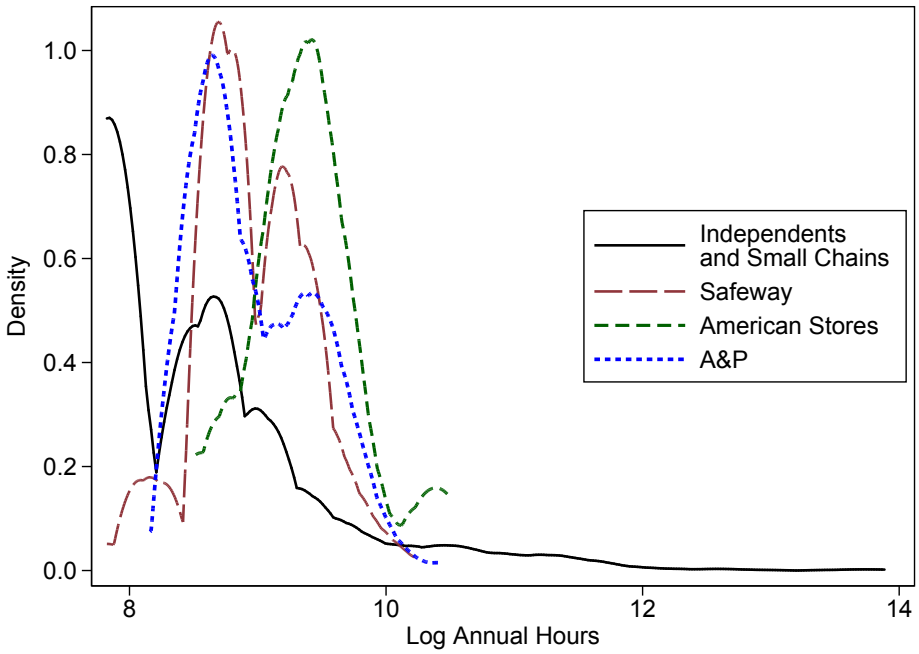
Notes: Authors' calculations from 1930 FTC Inquiry. The indexes are quantity-weighted using flour, sugar, and milk.

Figure 3. Revenue of Washington DC Grocery Stores, 1929



Source: Authors' calculations from 1929 Census of Distribution

Figure 4. Labor Input of Washington DC Grocery Stores, 1929

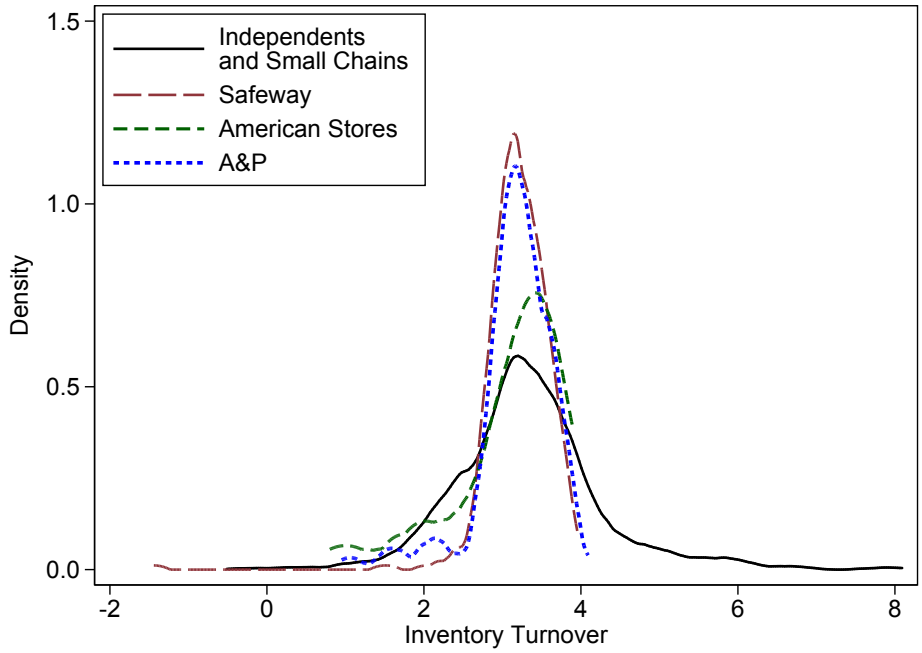


Source: Authors' calculations from 1929 Census of Distribution

Figure 5. Labor Productivity of Washington DC Grocery Stores, 1929

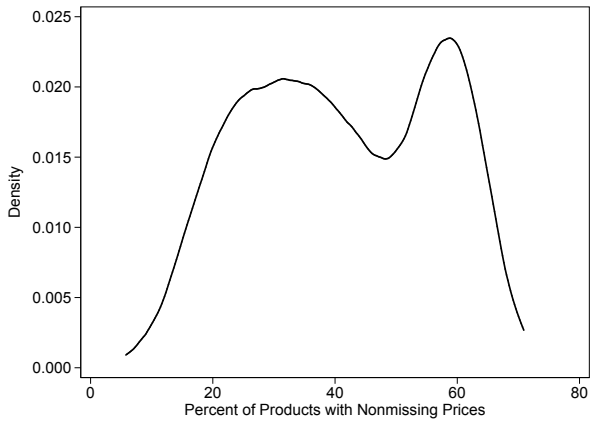
Source: Authors' calculations from 1929 Census of Distribution. Labor productivity is the log ratio of revenue to hours worked.

Figure 6. Inventory Turnover of Washington DC Grocery Stores, 1929

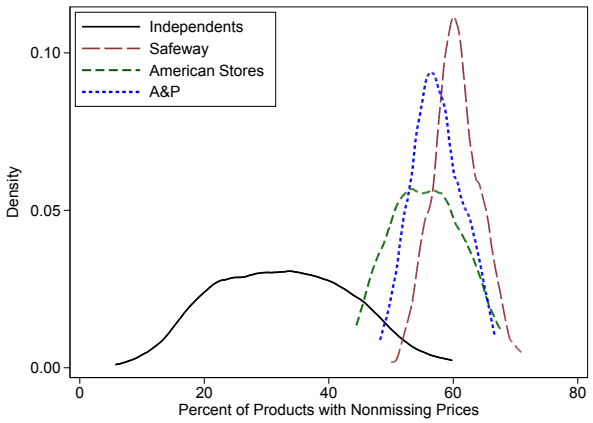


Source: Authors' calculations from 1929 Census of Distribution. Inventory turnover is the log ratio of revenue to inventory.

Figure 7. Percent of Products with Nonmissing Prices at Washington DC Grocery Stores, 1929



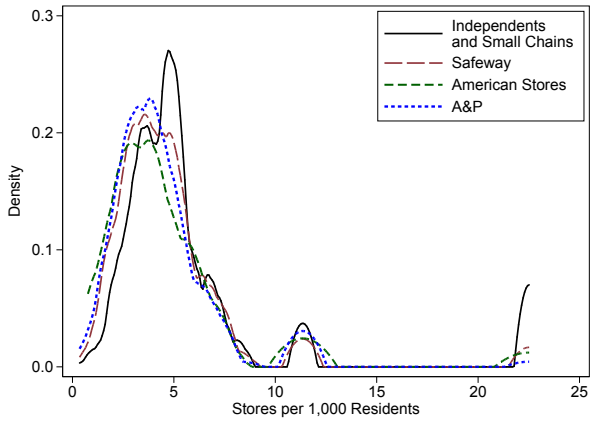
(a) All Stores



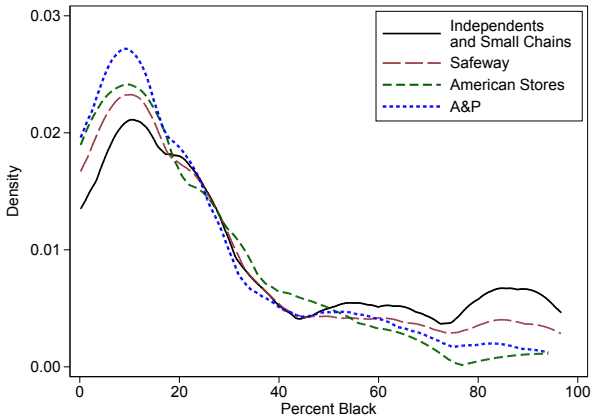
(b) Chains vs. Independents

Source: Authors' calculations from 1930 FTC Inquiry

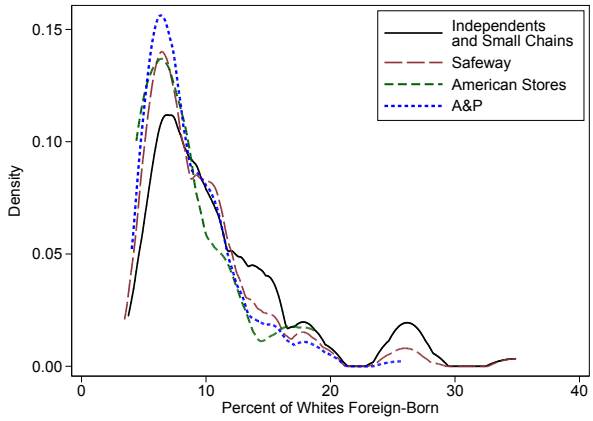
Figure 8. Local Population Characteristics of Stores



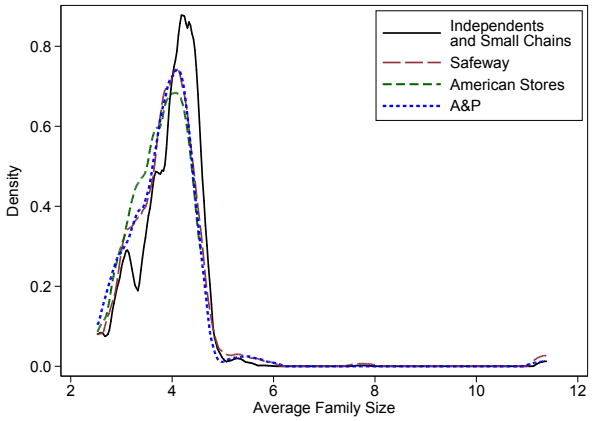
(a) Number of Stores per 1,000 People



(b) Percent Black Population



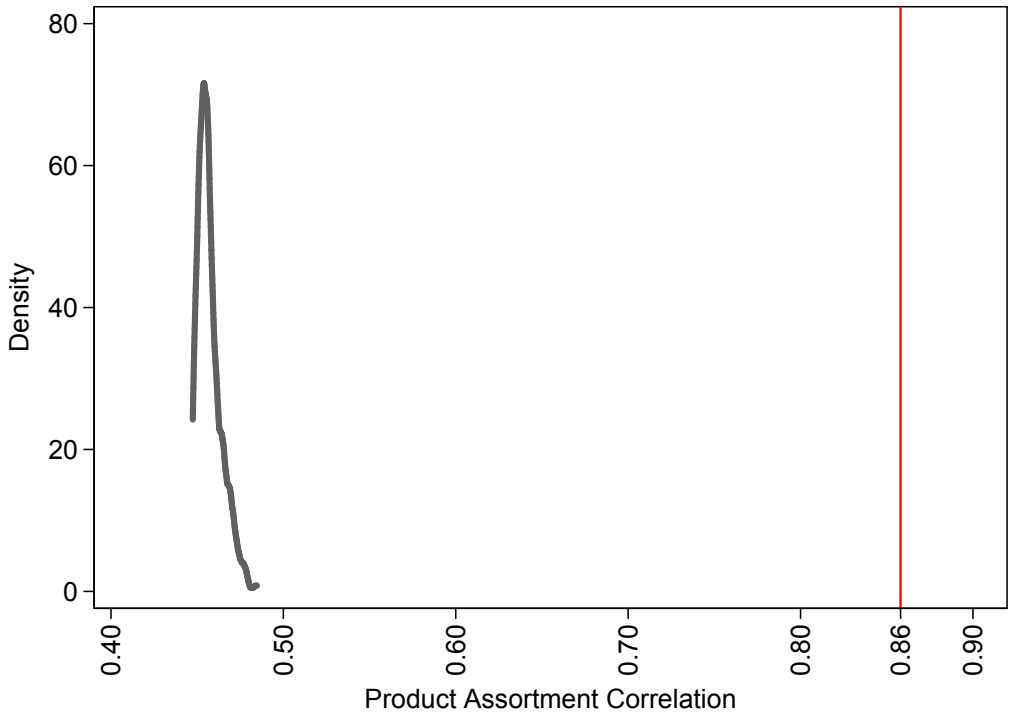
(c) Percent of White Population Foreign-Born



(d) Average Family Size

Source: Authors' calculations from 1930 Census of Distribution and 1930 Population Census.

Figure 9. Product Assortment Correlation for Quarts of Milk



Note: The red lines shows the product assortment statistic ρ in the sample of chains. The distribution in black is the density of values for ρ based on 250 simulations of store assortments under the null of random stocking of goods. This procedure is described in more detail in the text.

Table 1. Summary Statistics

Variable	Observations	Mean	Std Dev	Min	Max
Panel A: Full Sample					
Chain Store (%)	1,895	30.7	46.1	0	100
Stores in Firm	1,895	1,590.4	3,941.5	1	15,000
Big Three (%)	1,895	25.6	43.7	0	100
Store Revenue (1929 000$)	1,895	36.4	40.8	0.4	436.5
Proprietors (#)	1,895	0.9	1.9	0	80
Employees (#)	1,895	2.9	6.4	0	109
Worker Hours (Thousands)	1,886	8.8	15.7	2.5	272.5
Combination Store (%)	1,895	44.3	49.7	0	100
Delicatessen (%)	1,895	14.6	35.3	0	100
Labor Productivity (Sales per Hour)	1,886	4.8	3.1	0.1	42.5
Inventory Turnover	1,895	47.9	156.6	0.2	3269.9
Years under Current Owner	1,602	5.8	6.8	−1	50
Years since Business Formation	1,385	10.5	11.7	−1	89
Panel B: FTC Sample					
Chain Store (%)	427	2.1	14.4	0	100
Stores in Firm	427	1.0	0.4	1	8
Big Three (%)	427	0.0	0.0	0	0
Store Revenue (1929 000$)	427	29.3	36.2	0.5	389.4
Proprietors (#)	427	1.2	0.5	0	3
Employees (#)	427	1.6	3.2	0	36
Worker Hours (Thousands)	426	6.7	7.8	2.5	90
Combination Store (%)	427	59.7	49.1	0	100
Delicatessen (%)	427	18.5	38.9	0	100
Labor Productivity (Sales per Hour)	426	4.6	2.6	0.1	23.4
Inventory Turnover	427	28.9	17.7	2	108
Years under Current Owner	422	6.2	7.2	−1	48
Years since Business Formation	417	11.2	11.7	−1	89
Priced Products (of 450)	427	150.2	49.1	26	269
Price Index	425	103.2	5.3	66	120.9

Source: Authors' calculations based on sample from the 1929 Census of Distribution of grocery stores and the 1930 FTC Inquiry in Washington, DC.

Table 2. Summary Statistics: Independents vs. Chains
1929 Census of Distribution Grocery Stores in Washington, DC

	Independents	Chains			
Variable		All	Safeway	American Stores	A&P
Revenue (1929 000$)	27.59	59.64	62.54	53.70	53.84
	(39.57)	(35.85)	(29.32)	(40.32)	(32.81)
Worker Hours (Thousands)	8.22	10.37	8.51	12.96	8.83
	(16.20)	(14.16)	(3.95)	(7.04)	(4.71)
Revenue per Worker Hour	1.15	1.81	1.99	1.24	1.77
	(0.79)	(0.50)	(0.30)	(0.66)	(0.48)
Sales / Inventory	3.30	3.28	3.20	3.07	3.16
	(0.93)	(0.66)	(0.42)	(0.73)	(0.51)
Combination Store (%)	42.79	48.48	50.32	50.00	50.69
	(49.49)	(50.02)	(50.08)	(50.71)	(50.17)
Part-Time / Total Salaries (%)	8.49	5.13	4.85	6.94	6.06
	(23.30)	(5.10)	(3.27)	(5.92)	(6.86)

Notes: Independents include chains of 2–3 stores. All chains include other chains with 4+ stores nationwide. Standard deviations in parentheses.

Table 3. Survival Regressions: Full Sample

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Labor Productivity	3.55**						11.43***	12.57***
	(1.41)						(1.86)	(1.91)
Inventory Turnover		-4.89***					-6.38***	-7.73***
		(1.22)					(1.40)	(1.45)
Combination Store			11.16***				8.33***	5.89**
			(2.31)				(2.33)	(2.30)
Store Revenue				-2.07*			-3.72**	-0.05
				(1.06)			(1.56)	(1.64)
Store Age					2.40*		2.63**	1.12
					(1.33)		(1.31)	(1.30)
Competitors in Tract						-9.52***	-8.50***	-8.20***
						(2.11)	(2.08)	(2.04)
Chain Store								-20.73***
								(4.69)
A&P								16.15***
								(6.25)
American Stores								18.38*
								(10.00)
Safeway								-28.81***
								(6.19)
Demographics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1886	1895	1895	1895	1895	1891	1882	1882
R^2	0.038	0.042	0.047	0.037	0.082	0.045	0.129	0.178
Percent predicted outside $[0, 1]$	0.00	0.00	0.00	0.00	0.79	0.00	1.33	1.81
Survival Rate	46.50	46.39	46.39	46.39	46.39	46.48	46.60	46.60

Notes: These are linear probability models. The dependent variable takes takes a value of 100 if the store survives to 1935 and 0 otherwise. Heteroskedasticity-robust standard errors in parentheses. All regressions include Census tract-level variables: log population, log white population, log native-born population, and log population over age 21. All continuous independent variables are in logs.

Table 4. Survival Regressions: FTC Sample

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Labor Productivity	4.65							-4.14
	(3.84)							(5.25)
Inventory Turnover		2.39						1.48
		(3.79)						(4.27)
Store Revenue			6.28**					3.95
			(2.70)					(4.16)
Store Age				1.08				0.52
				(2.55)				(2.54)
Competitors in Tract					-11.00**			-7.73
					(5.02)			(5.15)
Number of Products						19.62***		13.59
						(6.64)		(8.35)
Price Index							-0.62	-0.69
							(0.46)	(0.46)
Demographics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	426	427	427	427	427	427	425	424
R^2	0.015	0.012	0.025	0.012	0.022	0.033	0.016	0.043
Percent predicted outside $[0, 1]$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Survival Rate	65.73	65.81	65.81	65.81	65.81	65.81	66.12	66.04

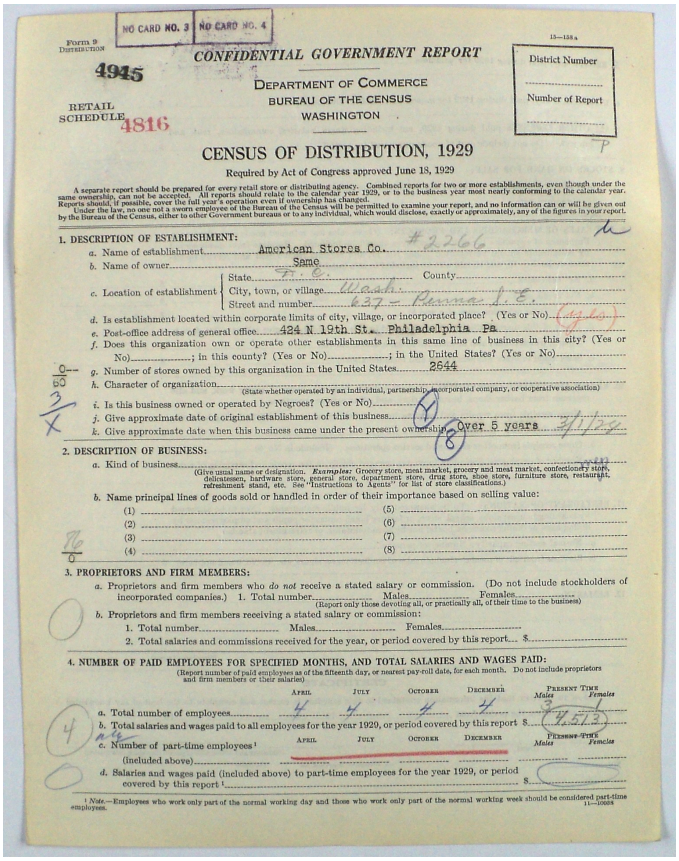
Notes: These are linear probability models. The dependent variable takes takes a value of 100 if the store survives to 1935 and 0 otherwise. Heteroskedasticity-robust standard errors in parentheses. All regressions include Census tract-level variables: log population, log white population, log native-born population, and log population over age 21. All continuous independent variables are in logs.

Table 5. Survival Regressions: "Big 3" Chain Stores

	(1)	(2)	(3)	(4)	(5)	(6)
Labor Productivity	6.99					-0.06
	(4.81)					(6.62)
Inventory Turnover		9.36**				16.21*
		(4.01)				(9.77)
Combination Store			1.76			-4.94
			(3.75)			(5.55)
Store Revenue				5.75*		-2.96
				(3.23)		(8.57)
Competitors in Tract					0.28	-0.08
					(3.29)	(3.27)
A&P	45.45***	43.45***	43.06***	44.35***	43.11***	43.88***
	(4.77)	(4.58)	(4.63)	(4.65)	(4.64)	(4.95)
American Stores	42.44***	38.44***	37.19***	39.22***	38.72***	40.05***
	(9.20)	(8.57)	(8.59)	(8.68)	(8.70)	(9.70)
Observations	482	485	485	485	483	480
R^2	0.217	0.218	0.209	0.214	0.211	0.225
Percent predicted outside $[0, 1]$	0.41	0.62	0.41	0.62	0.41	0.42
Survival Rate	31.12	30.93	30.93	30.93	31.06	31.25

Notes: These are linear probability models. The dependent variable takes takes a value of 100 if the store survives to 1935 and 0 otherwise. Heteroskedasticity-robust standard errors in parentheses. All regressions include Census tract-level variables: log population, log white population, log native-born population, and log population over age 21. All continuous independent variables are in logs.

Figure A-1. Sample CoD Schedule: American Stores Co., Washington DC



NO CARD NO. 3 NO CARD NO. 4

Form D
DISTRIBUTION

4945

RETAIL SCHEDULE 4816

CONFIDENTIAL GOVERNMENT REPORT

DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS
WASHINGTON

15—138 a

District Number

Number of Report

CENSUS OF DISTRIBUTION, 1929

Required by Act of Congress approved June 18, 1929

A separate report should be prepared for every retail store or distributing agency. Combined reports for two or more establishments, even though under the same ownership, can not be accepted. All reports should relate to the calendar year 1929, or to the business year most nearly conforming to the calendar year. Reports should, if possible, cover the full year's operation even if ownership has changed.
Under the law, no one not a sworn employee of the Bureau of the Census will be permitted to examine your report, and no information can or will be given out by the Bureau of the Census, either to other Government bureaus or to any individual, which would disclose, exactly or approximately, any of the figures in your report.

1. DESCRIPTION OF ESTABLISHMENT:

a. Name of establishment: American Stores Co.
b. Name of owner: Same
c. Location of establishment — State: D. C. County:
City, town, or village: Wash. Parmac, D. C.
Street and number: 637 –
d. Is establishment located within corporate limits of city, village, or incorporated place? (Yes or No)
e. Post-office address of general office: 424 N 19th St. Philadelphia Pa
f. Does this organization own or operate other establishments in this same line of business in this city? (Yes or No); in this county? (Yes or No); in the United States? (Yes or No)
g. Number of stores owned by this organization in the United States: 2644
h. Character of organization
(State whether operated by an individual, partnership, incorporated company, or cooperative association)
i. Is this business owned or operated by Negroes? (Yes or No)
j. Give approximate date of original establishment of this business:
k. Give approximate date when this business came under the present ownership: Over 5 years

2. DESCRIPTION OF BUSINESS:

a. Kind of business:
(Give usual name or designation. *Examples:* Grocery store, meat market, grocery and meat market, confectionery store, delicatessen, hardware store, general store, department store, drug store, shoe store, furniture store, restaurant, refreshment stand, etc. See "Instructions to Agents" for list of store classifications.)
b. Name principal lines of goods sold or handled in order of their importance based on selling value:
(1) (2) (3) (4) (5) (6) (7) (8)

3. PROPRIETORS AND FIRM MEMBERS:

a. Proprietors and firm members who *do not* receive a stated salary or commission. (Do not include stockholders of incorporated companies.) 1. Total number: Males: Females:
(Report only those devoting all, or practically all, of their time to the business)
b. Proprietors and firm members receiving a stated salary or commission:
1. Total number: Males: Females:
2. Total salaries and commissions received for the year, or period covered by this report: $

4. NUMBER OF PAID EMPLOYEES FOR SPECIFIED MONTHS, AND TOTAL SALARIES AND WAGES PAID:
(Report number of paid employees as of the fifteenth day, or nearest pay-roll date, for each month. Do not include proprietors and firm members or their salaries)

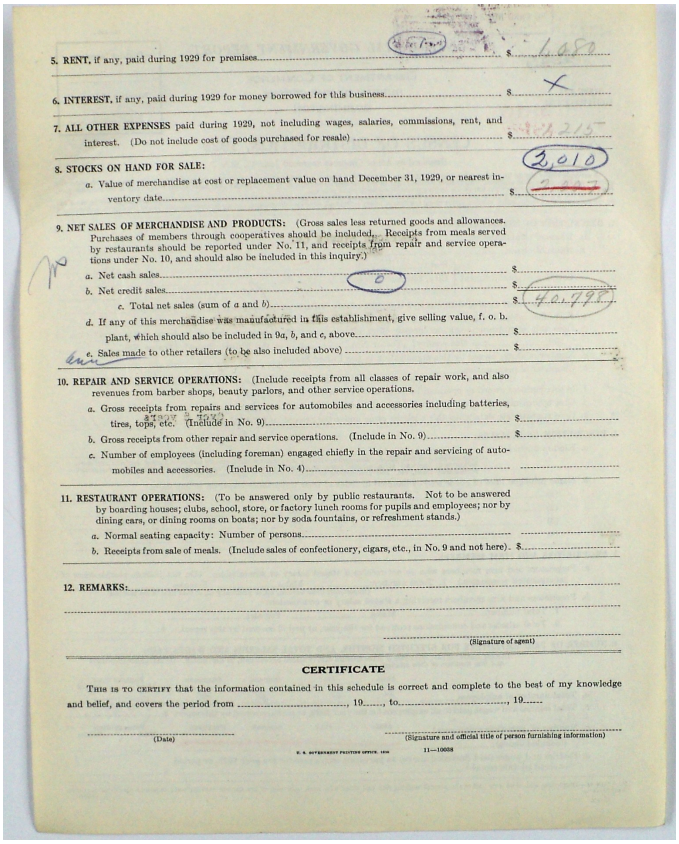
	April	July	October	December	Present Time Males	Present Time Females
a. Total number of employees	4	4	4	4	3	1
b. Total salaries and wages paid to all employees for the year 1929, or period covered by this report $					(7,013)	
c. Number of part-time employees [1] (included above)						

	April	July	October	December	Present Time Males	Present Time Females

d. Salaries and wages paid (included above) to part-time employees for the year 1929, or period covered by this report [1]: $

[1] Note.—Employees who work only part of the normal working day and those who work only part of the normal working week should be considered part-time employees.

11—10038



5. RENT, if any, paid during 1929 for premises: $ 1,080

6. INTEREST, if any, paid during 1929 for money borrowed for this business: $ X

7. ALL OTHER EXPENSES paid during 1929, not including wages, salaries, commissions, rent, and interest. (Do not include cost of goods purchased for resale): $ 2,215

8. STOCKS ON HAND FOR SALE:

a. Value of merchandise at cost or replacement value on hand December 31, 1929, or nearest inventory date: $ 2,010

9. NET SALES OF MERCHANDISE AND PRODUCTS: (Gross sales less returned goods and allowances. Purchases of members through cooperatives should be included. Receipts from meals served by restaurants should be reported under No. 11, and receipts from repair and service operations under No. 10, and should also be included in this inquiry.)

a. Net cash sales: $
b. Net credit sales: $ 0
c. Total net sales (sum of a and b): $ 40,796
d. If any of this merchandise was manufactured in this establishment, give selling value, f. o. b. plant, which should also be included in 9a, b, and c, above: $
e. Sales made to other retailers (to be also included above): $

10. REPAIR AND SERVICE OPERATIONS: (Include receipts from all classes of repair work, and also revenues from barber shops, beauty parlors, and other service operations.)

a. Gross receipts from repairs and services for automobiles and accessories including batteries, tires, tops, etc. (Include in No. 9): $
b. Gross receipts from other repair and service operations. (Include in No. 9): $
c. Number of employees (including foreman) engaged chiefly in the repair and servicing of automobiles and accessories. (Include in No. 4):

11. RESTAURANT OPERATIONS: (To be answered only by public restaurants. Not to be answered by boarding houses; clubs, school, store, or factory lunch rooms for pupils and employees; nor by dining cars, or dining rooms on boats; nor by soda fountains, or refreshment stands.)

a. Normal seating capacity: Number of persons:
b. Receipts from sale of meals. (Include sales of confectionery, cigars, etc., in No. 9 and not here): $

12. REMARKS:

(Signature of agent)

CERTIFICATE

THIS IS TO CERTIFY that the information contained in this schedule is correct and complete to the best of my knowledge and belief, and covers the period from , 19, to , 19

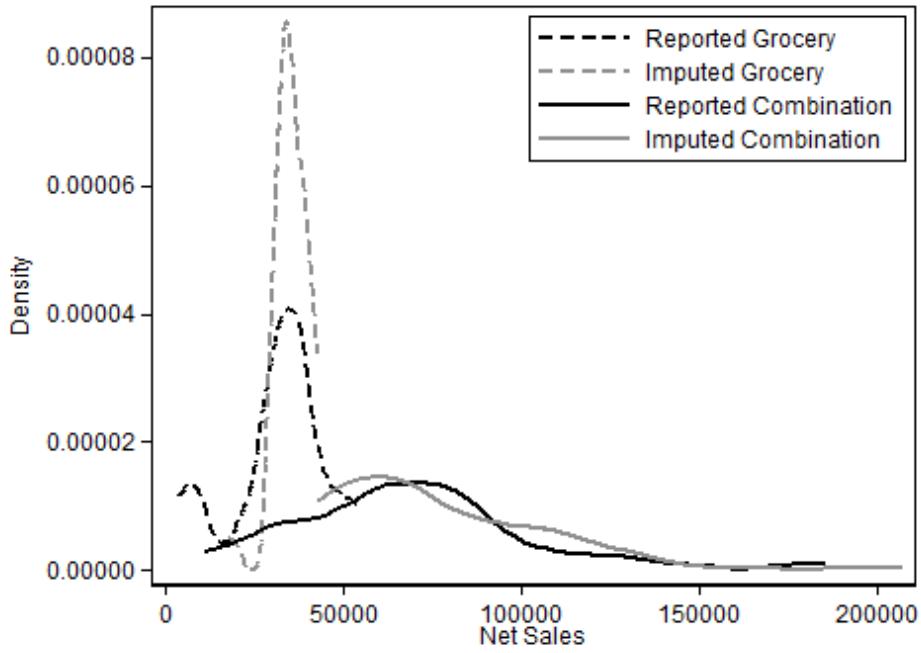
(Date)

(Signature and official title of person furnishing information)

U. S. GOVERNMENT PRINTING OFFICE, 1929

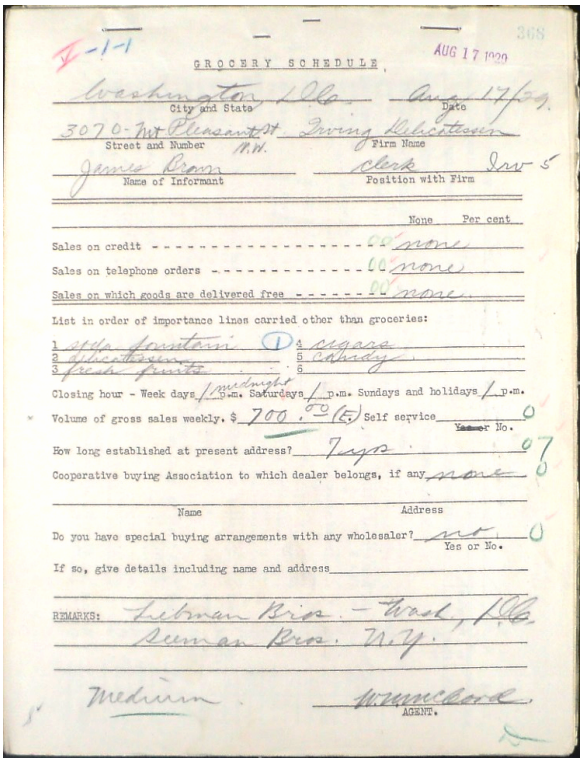
11—10038

Figure A-2. A&P Store Revenue, Grocery vs. Combination Stores



Notes: Authors' calculations from 1929 Census of Distribution and Boyd's 1935 District of Columbia Directory

Figure A-3. Sample FTC Schedule: Irving Delicatessen, Washington DC



GROCERY SCHEDULE

AUG 17 1929

Washington, D.C. — Aug. 17/29.
City and State — Date

3070 Mt Pleasant St. N.W. — Irving Delicatessen
Street and Number — Firm Name

James Brom — Clerk — Inv-5
Name of Informant — Position with Firm

	None	Per cent
Sales on credit	00	none
Sales on telephone orders	00	none
Sales on which goods are delivered free	00	none

List in order of importance lines carried other than groceries:

1 Delicatessen (1) 4 cigars
2 Confectionery 5 Cakes
3 Fresh fruits 6

Closing hour - Week days 6 p.m. midnight Saturdays 1 p.m. Sundays and holidays 1 p.m.

Volume of gross sales weekly, $ 700.00 (E) Self service 0
Yes or No.

How long established at present address? 7 yrs. 07

Cooperative buying Association to which dealer belongs, if any none 0

Name — Address

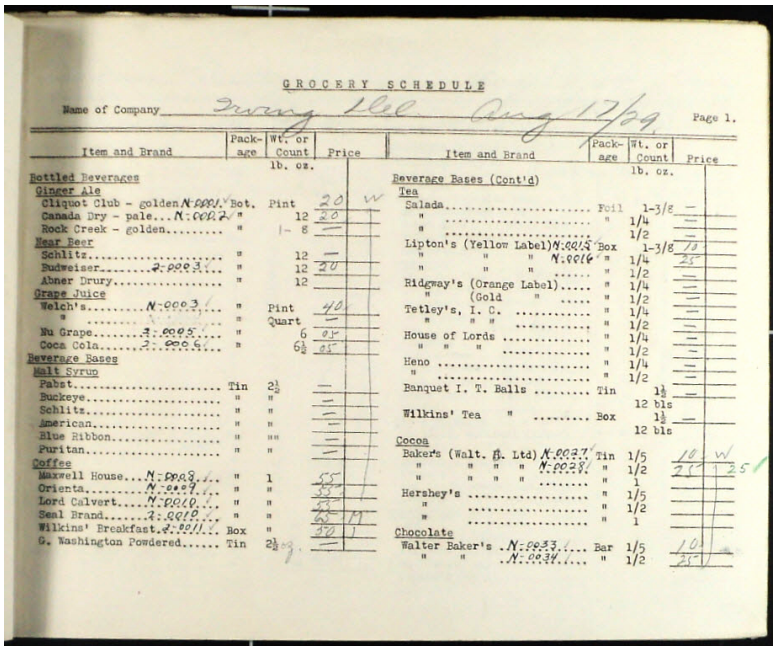
Do you have special buying arrangements with any wholesaler? no 0
Yes or No.

If so, give details including name and address

REMARKS: Liebman Bros. - Wash, D.C.
Liebman Bros. N.Y.

Medium

AGENT.



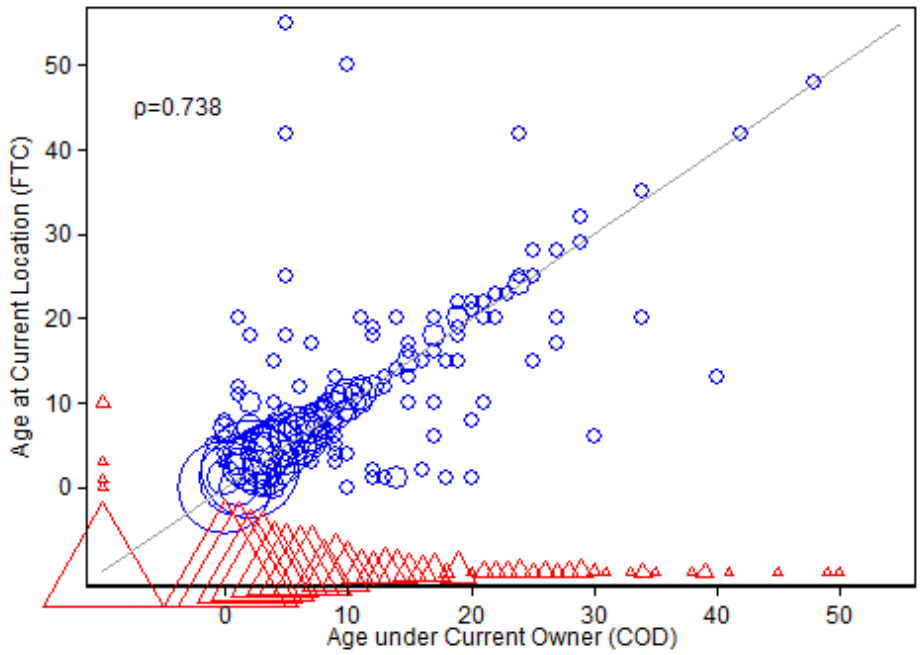
GROCERY SCHEDULE

Name of Company Irving Del Aug 17/29 Page 1.

Item and Brand	Package	Wt. or Count lb. oz.	Price
Bottled Beverages			
Ginger Ale			
Cliquot Club - golden N:0001	Bot.	Pint	20 W
Canada Dry - pale...N:0002	"	12	20
Rock Creek - golden.....	"	8	
Near Beer			
Schlitz.....	"	12	
Budweiser.....2:0003...	"	12	20
Abner Drury.....	"	12	
Grape Juice			
Welch's.....N:0003...	"	Pint	40
"	"	Quart	
Nu Grape.....2:0005...	"	6	05
Coca Cola.....2:0006...	"	6½	05
Beverage Bases			
Malt Syrup			
Pabst.....	Tin	2½	
Buckeye.....	"	"	
Schlitz.....	"	"	
American.....	"	"	
Blue Ribbon.....	"	"	
Puritan.....	"	"	
Coffee			
Maxwell House...N:0008...	"	1	55
Orienta.....N:0009...	"	"	55
Lord Calvert.....N:0010...	"	"	55
Seal Brand.....2:0010...	"	"	50 W
Wilkins' Breakfast.2:0011...	Box	"	50 1
G. Washington Powdered.....	Tin	2½ oz.	

Item and Brand	Package	Wt. or Count lb. oz.	Price
Beverage Bases (Cont'd)			
Tea			
Salada.....	Foil	1-3/8	
"	"	1/4	
"	"	1/2	
Lipton's (Yellow Label) N:0015	Box	1-3/8	70
" " " N:0016	"	1/4	25
" " "	"	1/2	
Ridgway's (Orange Label).....	"	1/4	
" (Gold "	"	1/2	
Tetley's, I. D.	"	1/4	
" " "	"	1/2	
House of Lords	"	1/4	
" " "	"	1/2	
Heno	"	1/4	
"	"	1/2	
Banquet I. T. Balls	Tin	1½ 12 bls	
Wilkins' Tea "	Box	1½ 12 bls	
Cocoa			
Baker's (Walt. H. Ltd) N:0027	Tin	1/5	10 W
" " " " N:0028	"	1/2	25 25
" " "	"	1	
Hershey's	"	1/5	
"	"	1/2	
"	"	1	
Chocolate			
Walter Baker's .N:0033.....	Bar	1/5	10
" " .N:0034.....	"	1/2	25

Figure A-4. Age under Current Owner (CoD) vs. Age at Current Location (FTC)



Notes: Marker size represents number of observations. Triangles represent observations with missing data in one or both sources.